1. A viscous fluid clutch for use in a vehicle comprising:

a rotor having a rotor hub driven by an input shaft and a rotor surface having an end connected to an outer periphery of the rotor hub, the rotor surface including:

a first portion;

a second portion; and

a grooved portion disposed between the first and second portions and having a W-V shaped profile;

wherein the first and second portions of the rotor each have a thickness sufficiently greater than a thickness of the grooved portion such that a magnetic flux path in the fluid clutch will have a substantial portion of a magnetic field flow around the grooved portion as compared to a portion of the magnetic field flow that flows through the grooved portion.

2. A magnetorheological fluid clutch, comprising:

an input shaft;

a coil assembly for generating a magnetic field;

a housing comprising a stator; and

a rotor disposed in the housing;

wherein the rotor includes a radially extending hub driven by the input shaft and an annular rotor ring connected to the hub; and

wherein the rotor ring includes a first portion, a second portion, and a portion of reduced thickness disposed between the first and second portions to prevent a shunt in the magnetic field, and

wherein the portion of reduced thickness has a W-V shaped cross-section.

3. The magnetorheological fluid clutch of claim 2, wherein the thickness of the first portion and the thickness of the second portion are at least seven times greater than the thickness of the portion of reduced thickness.

4. The magnetorheological fluid clutch of claim 2, wherein the portion of reduced thickness is formed to include grooves and protrusions.

5. The magnetorheological fluid clutch of claim 4, wherein the grooves and protrusions form a W-shape.

6. The magnetorheological fluid clutch of claim 2, wherein the portion of reduced thickness is formed without cutting.

7. The magnetorheological fluid clutch of claim 2, wherein the rotor ring comprises a ferrous metal.

8. The magnetorheological fluid clutch of claim 2, wherein the rotor ring comprises a non-ferrous material.

9. A fan drive assembly for use in a vehicle, the fan drive assembly including the magnetorheological fluid clutch of claim 2.

10. A fan mounting arrangement for a fan clutch, wherein the fan clutch includes a housing having a hub mounting portion and a fan blade hub mounted thereto, the fan mounting arrangement comprising:

fasteners having tri-lobular threads,

wherein the tri-lobular threads are engaged with corresponding roll formed threads in the fan housing, the roll formed threads being configured to substantially reduce leakage of fluid from an interior of the fan housing to an exterior of the fan housing.

11. A fan mounting arrangement, comprising:

a fan housing including a hub mounting portion for mounting a fan blade hub;

a fan blade having a plurality of blades extending from a periphery of a hub; and

fasteners connecting the fan blade hub to the hub mounting portion of the fan housing;

wherein the fasteners include tri-lobular threads engaged with corresponding threads of the fan housing; and

wherein the corresponding threads are roll formed threads to substantially reduce leakage of fluid past the corresponding threads from an interior of the fan housing to an exterior of the fan housing.

12. A fan clutch including the fan mounting arrangement of claim 11.

13. The fan clutch of claim 12, wherein the fan clutch comprises a magnetorheological fluid fan clutch.

14. A method of mounting a fan blade to a fan housing, comprising:

providing a cast fan housing including a hub mounting portion, wherein the hub mounting portion includes unthreaded pilot holes for mounting a fan blade hub to the hub mounting portion;

providing a fan blade having a plurality of blades extending from a periphery of a hub, wherein the hub includes bolt holes arranged to correspond to the pilot holes on the hub mounting portion;

providing at least one fastener having tri-lobular threads;

aligning the bolt holes of the fan blade hub with the corresponding pilot holes of the hub mounting portion;

inserting the fastener into one of the bolt holes until the fastener contacts a wall of the pilot hole;

forming rolled threads in the wall of the pilot hole by rotating the fastener.

15. The method of claim 14, further comprising applying a torque of approximately 30 N-m to the fastener.

16. A cooling device for a vehicle fan clutch having a housing including cooling fins disposed on the housing facing toward a direction of air flow, the cooling device comprising:

a diffuser element including a first surface aligned to direct air toward the cooling fins; and

a connector element having a first portion connected to the diffuser element and a second portion for connection with the vehicle fan clutch,

wherein the diffuser element and the connector element are configured to prevent stagnation of the air at a central area of the housing.

17. An air-directing device to increase the cooling effect for a housing of a fan clutch, the housing having a plurality of fins located on an external surface of the housing, the air-directing device comprising:

a diffuser element configured to be disposed on a front end of the finned housing;

a connector element disposed within the diffuser element,

wherein the diffuser element and the connector element are configured to reduce stagnation of air in the vicinity of the finned housing when air is flowing toward the front end of the finned housing.

18. The air directing device of claim 17, wherein the diffuser element comprises a frustoconical diffuser element.

19. The air-directing device of claim 17, wherein the connector element includes a cone shaped portion having a larger diameter end located adjacent the housing and a smaller diameter end located away from the housing.

20. The air-directing device of claim 17, wherein the diffuser element is connected to the connector element by at least one extension member.

21. The air-directing device of claim 20, wherein the connector element is connected to the diffuser element by three radially extending, angularly displaced extension members.

22. A fan clutch including the air-directing device of claim 17.

23. The fan clutch of claim 22, wherein the connector element is connected to an electrical cap disposed on a fan clutch housing.

24. The fan clutch of claim 23, wherein the fan clutch housing includes curved fins configured to reduce flow separation along the fins.

25. A fluid clutch having a first housing member including a cast housing portion cast around an annular housing insert and a second housing member to be connected to the first housing member, the connected first and second housing members adapted to be rotatably disposed on an input shaft, the fluid clutch comprising:

an annular extension member located on one of a periphery of the first housing insert and the cast housing portion and an annular complimentary groove located on the other of the periphery of the first housing insert and the cast housing portion, wherein the extension member mechanically engages the complimentary groove to lock the housing insert and the cast housing portion; and

wherein the cast housing portion has a first associated coefficient of heat expansion and the housing insert has a second associated coefficient of heat expansion different than the first coefficient of heat expansion such that when the first housing member is heated when the fluid clutch is operated, the extension member more positively engages the complimentary groove and prevents fluid from leaking there past

26. The fluid clutch of claim 25, wherein the annular extension member comprises an annular thread and the complimentary groove comprises an annular complimentary thread mechanically engaging the housing insert to the cast housing portion such that movement of the insert relative to the cast housing portion causes the insert to be more securely threaded with the cast housing portion.

27. The fluid clutch of claim 26, wherein the cast housing portion comprises a radially extending annular surface.

28. A fluid clutch comprising:

an input shaft;

a rotor connected to the input shaft;

a housing including a first housing portion connected to a second housing portion, wherein the second housing portion is rotatably disposed on the input shaft;

an annular housing insert, wherein the first housing portion is cast around the housing insert; and

a coil assembly engaged with the housing insert,

wherein one of a periphery of the first housing portion and the housing insert includes an annular projection and a periphery of the other of the first housing portion and the housing insert includes an annular groove, and

wherein the annular projection and the annular groove mechanically engage to prevent separation of the first housing portion and the housing insert.

29. The fluid clutch of claim 28, wherein the first housing portion comprises a radially extending surface.

30. The fluid clutch of claim 28, wherein the first housing portion comprises a material having a first coefficient of heat expansion and the housing insert comprises a material having a second coefficient of heat expansion different than the first coefficient of heat expansion.

31. The fluid clutch of claim 28, wherein the annular projection comprises an annular thread and the annular groove comprises an annular complimentary thread.

32. The fluid clutch of claim 31, wherein the annular thread is a square profile thread.

33. The fluid clutch of claim 31, wherein the annular thread and the complimentary thread mechanically engage the first housing portion and the housing insert so that movement of the housing insert relative to the first housing portion during the operation of the fluid clutch is in a direction of engagement of the annular thread and the complimentary thread.

34. The fluid clutch of claim 33, wherein the annular thread is a right hand thread and the fluid clutch is designed to rotate in a counterclockwise direction as viewed from a forward end of the fluid clutch.

35. A coil assembly for generating a magnetic field in a fluid clutch comprising:

a winding member;

a central shaft;

a crossbar member extending between the winding member and the central shaft;

a wire wound around the winding member having a first end and a second end, the first end and the second end extending through the crossbar and into the central shaft;

a magnet including a first ring and a second ring configured to engage a brush box, the first ring being coupled to the first end of the wire and the second ring being coupled to the second end of the wire; and

an electrically insulating, non-magnetic cover substantially surrounding at least the winding ring and configured to prevent a shunt in the magnetic field;

wherein the cover is made from a single-stage phenolic molding compound.

36. The coil assembly of claim 35, wherein the cover completely surrounds the crossbar member and the central shaft.

37. The coil assembly of claim 35, wherein the cover substantially encapsulates the winding member.

38. The coil assembly of claim 35, the wherein the cover is molded over the winding ring.

39. A coil assembly for a viscous fluid clutch, comprising:

a bobbin including a winding ring having a crossbar;

a central shaft extending from the crossbar;

a first magnet disposed on an outer periphery of the central shaft;

a second magnet disposed on an outer periphery of the central shaft;

a first lead connected to the first magnet and extending through the central shaft into a first portion of the cross bar;

a second lead connected to the second magnet and extending through the central shaft into a second portion of the cross bar; and

a wire wrapped around the winding ring and including a first end in contact with the first lead in the first portion of the cross bar and a second end in contact with the second lead in the second portion of the crossbar,

wherein the bobbin, the winding ring, the central shaft, and the wire are over-molded with a resin.

40. The coil assembly of claim 39, wherein the resin is a single stage phenolic polymer resin.

41. The coil assembly of claim 39, wherein the resin comprises a thermosetting epoxy.

42. The coil assembly of claim 39, wherein the winding ring and the crossbar are disposed between a first housing cover and a coil cover for use in a magnetorheological fluid clutch.

43. The coil assembly of claim 42, wherein the first housing cover and the coil cover are mechanically joined.

44. A fan mounting arrangement for a fan clutch of the type in which a fan blade hub is fastened to a hub mounting portion of a fan housing, the fan having an axis of rotation, the fan mounting arrangement comprising:

at least three angularly spaced mounting pad portions located on the hub mounting portion and each mounting pad portion configured to have the fan blade hub fastened thereto; and

at least three contact pad portions angularly disposed on the hub mounting portion such that each contact pad portion has a mounting pad portion on each side of it and each mounting pad portion has a contact pad portion on each side of it,

wherein the contact pad portions are offset from the mounting pad portions in a direction aligned with an axis of rotation of the fan clutch so that the contact pad portions apply a force to the fan blade hub when the fan blade hub is

securely fastened to the hub mounting portion such that fewer fasteners are needed to securely fasten the fan blade to the fan clutch.

45. A mounting arrangement for mounting a fan blade having a fan blade hub to a housing, the mounting arrangement comprising:

the housing including a mounting portion for having the fan blade hub mounted thereto;

wherein the mounting portion of the housing includes a plurality of angularly spaced mounting pads and a plurality of angularly spaced contact pads; and

wherein the contact pads are configured to apply a force in a direction aligned with an axis of rotation of the housing to the fan blade hub when the fan blade hub is mounted to the mounting portion of the housing.

46. The fan mounting arrangement of claim 45, wherein at least one contact pad is offset to be in a plane different than a plane containing the at least one mounting pad.

47. The fan mounting arrangement of claim 46, wherein the contact pad is offset from the housing in a direction aligned with the axis of rotation of the housing.

48. A magnetorheological fluid clutch, comprising:

an input shaft;

a cast housing including a first housing portion engaged with a coil assembly and a second housing portion rotatably disposed on the input shaft; and

a rotor assembly disposed between the first housing portion and the second housing portion,

wherein the first housing portion includes a hub mounting portion for mounting a fan blade hub,

wherein the hub mounting portion includes three angularly disposed mounting pad portions each configured to receive a fastener for mounting the fan blade hub thereto and three angularly disposed contact pad portions, and

wherein the contact pad portions are offset, in a direction aligned with the axis of rotation of the input shaft, from the mounting pad portions so that the contact pad

portions apply a force to the fan blade hub when the fan blade hub is securely fastened to the hub mounting portion.

49. A fluid clutch for use in a vehicle, the fluid clutch including a rotor having a rotor hub driven by an input shaft and a rotor surface having an end connected to an outer periphery of the rotor hub, the fluid clutch comprising:

the rotor surface including a first portion, a second portion, and a roll formed portion disposed between the first and second portions,

wherein the first and second portions of the rotor each have a thickness sufficiently greater than a thickness of the roll formed portion such that a magnetic flux path in the fluid clutch will have a substantial portion of a magnetic field flow around the roll formed portion as compared to a portion of the magnetic field flow that flows through the roll formed portion.

50. The fluid clutch of claim 49, wherein the roll formed portion of the rotor has a saw tooth profile.

51. The fluid clutch of claim 49, wherein the roll formed portion of the rotor has a W-W shaped profile.

52. A magnetorheological fluid clutch, comprising:

an input shaft;

a coil assembly for generating a magnetic field;

a housing comprising a stator; and

a rotor disposed in the housing,

wherein the rotor includes a radially extending hub driven by the input shaft and an annular rotor ring connected to the hub, and

wherein the rotor ring includes a first portion, a second portion, and a thinned center portion disposed between the first and second portions to prevent a shunt in the magnetic field, and

wherein the thinned portion has a saw tooth shaped profile.

53. The magnetorheological fluid clutch of claim 52, wherein the thickness of the first portion and the thickness of the second portion are at least seven times greater than the thickness of the rolled portion.

54. The magnetorheological fluid clutch of claim 52, wherein the roll formed portion is formed without cutting.

55. A viscous fluid clutch, comprising:

an input shaft;

a coil assembly;

a cast housing including a first housing portion connected to the coil assembly and a second housing portion rotatably disposed on the input shaft; and

a rotor assembly disposed between the first housing portion and the second housing portion,

wherein the rotor assembly includes a hub disposed on the input shaft and a rotor formed as a ring and having a side connected to an outer periphery of the hub, and

wherein the hub includes an annularly extending curved portion configured to compensate for dimensional changes of the hub and the effect on the rotor due to temperature variation of the viscous fluid clutch during operation.

56. The viscous fluid clutch of claim 55, wherein the rotor extends away from the hub and the curved portion of the hub includes a concave surface facing toward a direction of extension of the rotor ring.

57. The viscous fluid clutch of claim 56, wherein the curved portion is located to have the concave surface offset from the outer periphery of the hub.

58. The viscous fluid clutch of claim 57, wherein the concave surface is offset in a direction opposite from the direction of extension of the rotor ring.

59. The viscous fluid clutch of claim 55, wherein the curved portion comprises a concave surface facing toward the first housing portion and a convex surface facing toward the second housing portion.

60. The viscous fluid clutch of claim 55, wherein the rotor ring extends in a direction away from the hub and the curved portion of the hub comprises a concave surface disposed on the side of the hub facing in the direction of extension of the rotor ring.

61. The viscous fluid clutch of claim 55, wherein the viscous fluid clutch comprises a magnetorheological fluid clutch.

62. A method of making a rotor assembly for use in a viscous fluid clutch, the method comprising the steps of:

providing a magnetic material;

forming the magnetic material into a rotor ring;

roll forming the rotor ring to include a thinned central portion, wherein the first and second portions each have a thickness greater than a thickness of the thinned central portion;

providing a hub member; and

connecting the rotor ring to the hub member.

63. The method of claim 62, wherein the step of forming the magnetic material into a rotor ring includes the steps of providing a sheet of the magnetic material, cup drawing the magnetic material into a cup-shaped member, trimming the cup-shaped member to form a ring, and roll forming the ring.

64. The method of claim 63, further comprising the step of stamping the hub member and forming a curved portion between an inner periphery of the hub member and an outer periphery of the hub member.

65. The method of claim 62, wherein the step of connecting the rotor ring to the hub member includes crimping one of the first portion and the second portion of the rotor ring to an outer periphery of the hub member.

66. A combined coolant pump and fan assembly for a vehicle of the type in which an engine driven pulley is connected to the coolant pump and to the fan, the assembly comprising:

a first viscous fluid clutch coupled to the pulley; and

a second viscous fluid clutch coupled to the pulley,

wherein the first viscous fluid clutch is configured to drive the fan and the second viscous fluid clutch is configured to drive the coolant pump, and

wherein the first and second viscous fluid clutches are configured so that a speed of the first clutch is independently variable from a speed of the second clutch.

67. A combined fan clutch and coolant pump assembly for a vehicle, comprising:

a pulley configured to be driven by an engine;

a viscous fluid fan clutch coupled to the pulley; and

a viscous fluid coolant pump clutch coupled to the pulley,

wherein the viscous fluid fan clutch and the viscous fluid coolant pump clutch are configured so that a speed of the fan clutch is independent of a speed of the coolant pump.

68. The combined fan clutch and coolant pump assembly of claim 67, wherein the viscous fluid fan clutch includes an input shaft coupled to the pulley, a rotor assembly connected to the input shaft; a coil assembly; a first housing cover connected to the coil assembly; and a second housing cover rotatably disposed on the input shaft.

69. The combined fan clutch and coolant pump assembly of claim 67, wherein the viscous fluid coolant pump clutch includes a coil assembly disposed within the pulley; a rotor assembly; a coolant pump input shaft coupled to the rotor assembly; and a housing cover connected to the pulley.

70. The combined fan clutch and coolant pump assembly of claim 69, wherein the viscous fluid coolant pump clutch includes a permanent magnet configured to enable the rotor to drive the coolant pump input shaft when the coil assembly is de-energized.

71. The combined fan clutch and coolant pump assembly of claim 67, wherein the viscous fluid comprises a magnetorheological fluid.